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ARTIGO ORIGINAL

Functional capacity of patients with chronic stroke based upon their physical activity levels

Capacidade funcional de indivíduos pós-acidente vascular cerebral crônico baseada nos níveis de atividade física

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Abstract

Introduction: People with stroke commonly show low levels of physical activity and reduced functional capacity, independent of the severity of the impairments. The use of simple measures that are able to produce transferable information from clinical practice to life in society is crucial within clinic contexts. *Objective*: To compare the functional capacity of patients with chronic stroke based upon their physical activity levels. *Methods*: For this cross sectional study, functional capacity and levels of physical activity were assessed by the Duke Activity Status Index (DASI) and the adjusted activity score (AAS) of the Human Activity Profile (HAP), respectively. One-way analysis of variance (ANOVA), followed by LSD post-hoc tests were employed to investigate differences between the physical activity groups regarding their DASI scores. *Results*: Fifty-one individuals with mean age 58.8 ± 13.5 and a mean time since the onset of stroke of 25.5 ± 13.9 months participated. According to their HAP AAS, 18 individuals were classified as impaired, 28 as moderately active, and five as active. Between-group differences were observed for the DASI scores [$F_{(2,48)}$=13.72; $p < 0.01$]. *Conclusion*: Increases in functional capacity were observed with increases in physical activity levels.
Key-words: stroke, motor activity, activities of daily living.

Resumo

Introdução: Indivíduos pós acidente vascular cerebral (AVC) geralmente apresentam baixos níveis de atividade física e redução da capacidade funcional, independente da gravidade. O uso de medidas simples, capazes de transferir informações da prática clínica para a vida em sociedade, é crucial dentro do contexto clínico. *Objetivo*: Comparar a capacidade funcional dos indivíduos com AVC crônico estratificados pelo nível de atividade física. *Métodos*: Para este estudo transversal, a capacidade funcional e os níveis de atividade física foram avaliados pelo *Duke Activity Status Index* (DASI) e pelo escore de atividade ajustado (EAA) do Perfil de Atividade Humana (PAH), respectivamente. Análise de variância *One-way* (ANOVA), seguida de testes post-hoc LSD foram realizados para investigar diferenças entre os níveis de atividade física considerando os escores do DASI. *Resultados*: Cinquenta e um indivíduos com idade média de 58,8 ± 13,5 anos e tempo médio pós AVC de 25,5 ± 13,9 meses participaram. De acordo com o EAA PAH, 18 indivíduos foram classificados como inativos, 28 como moderadamente ativos, e 5 como ativos. Diferenças entre-grupos foram observadas para os escores do DASI [$F_{(2,48)}$ = 13,72; $p < 0,01$]. *Conclusão*: Aumentos na capacidade funcional foram observados com aumentos nos níveis de atividade física.
Palavras-chave: acidente vascular cerebral, atividade física, atividades cotidianas.

Introduction

Physical activity practice has shown to positively influence multiple physical and psychosocial domains after stroke [1]. The literature supports that exercise after stroke improve cardiovascular fitness [2], walking ability [3] and strength of the upper-extremity and lower-extremity muscles [4]. Additionally, the benefits of physical activity on depressive symptoms, memory, and fatigue were reported [5-7]. Although it is it well known the importance of physical activity practice, stroke individuals commonly demonstrate low levels of physical activity [8].

Functional capacity after stroke is also frequently reduced, independent of the severity of the impairments [9]. Since functional capacity is related to physiological variables, i.e., oxygen consumption, the use of simple and reliable measures is crucial within clinical environments. Although the Duke Activity Status Index (DASI) was originally developed for the evaluation of patients with cardiovascular diseases [10], it has also been used with stroke individuals, since its scores were shown to be highly related to physical performance measures [11].

Also, DASI showed significant positive correlations with VO2 max ($r = 0.51$, $p < 0.001$) in patients with cardiovascular diseases [10]. In addition, this instrument was correlated with the distance covered in the six-minute walk test ($r = 0.55$) in patients with chronic obstructive pulmonary disease (COPD) [12]. In this sense, the instrument was validated and have adequate measurement properties for different populations.

Given the need to use simple clinical measures, which are able to produce transferable information from clinical practice to life in society, the aim of this study was to compare functional capacity of chronic stroke individuals, based upon their physical activity levels. Therefore, the specific research question for this study was: Stroke individuals with different levels of physical activity show differences in functional capacity?

Material and methods

Participants

For this cross-sectional study, people with chronic stroke were recruited from the general community of the city of Belo Horizonte, Brazil from September to December 2014. They were included if they: were ≥ 20 years of age; had a mean time since the onset of a unilateral stroke between one and five years, and were able to walk independently. They were excluded if they had cognitive deficits, as determined by the Mini-Mental State Examination Brazilian cut-off scores (18/19 for illiterate individuals and 24/25 for those with a basic education) [13] and/or had any other neuromuscular and musculoskeletal disorders. As participants provided written consent, based upon previous approval from the Institutional ethical review board (CAAE: 0254.0.203.000-11).

First, for characterization purposes, all participants underwent a physical examination and an interview for the collection of clinical, anthropometric, and demographic data, which included age, sex, body mass, height, time since the onset of the stroke, number of medications, associated diseases, and comfortable walking speed (10-meter walking test) [14]. Following, clinical measures of functional capacity and physical activity levels were collected by one trained researcher.

Functional capacity

The participants' perceived functional capacity was assessed by the Brazilian version of the DASI [10,15], which has demonstrated adequate measurement properties [10]. The DASI scores reflect the role of physiological factors on the individuals' daily lives and consider all relevant spheres related to functional capacity status, including personal care, ambulation, household tasks, sexual function, and recreation [16]. The DASI contains 12 items with a yes/no response format, which describes activities of daily living and their correspondent metabolic equivalents (METS). Its scores range from zero to 58.2 and higher scores indicates greater functional capacity.

Levels of physical activity

The individuals' levels of physical activity were assessed by the Brazilian version of the HAP [17], a survey including 94 activities, such as self-care, transportation, home maintenance, entertainment/social, and physical exercises, which are sequentially rated according to their required metabolic equivalents, so that a score of 1 represents the lowest and 94 the highest metabolic equivalent value. For example, item number 1 corresponds to getting in and out of chairs or bed without help, whereas item number 94 corresponds to running or jogging 4.8 kilometres in 30 minutes or less.

For each item, there were three possible responses: "still doing the activity", "have stopped doing the activity", and "never did the activity". The administration and scoring procedures followed recommended protocols [18,19] and scores were tallied to provide a maximum activity score, which indicated the highest metabolic equivalent activity level, at which the individual could still perform. An adjusted activity score (AAS) was determined by subtracting the number of activities that the respondent had discontinued performing from the maximum score and indicated the average typical metabolic equivalent levels. From the AAS values, the participants were classified into impaired (AAS<53), moderately activity (53<AAS<74), and active (AAS>74) [18]. Coefficients for test-retest reliability have been reported at 0.84 for the maximum and 0.79 for the adjusted activity scores [20].

Data analyses

Descriptive statistics and tests for normality (Shapiro-Wilk) were carried-out for all outcomes. Kruskal-Wallis was performed, followed by Mann-Whitney a post-hoc test was employed to investigate differences between the impaired, moderately active, and active groups regarding their DASI scores. All analyses were performed with the SPSS for Windows software (Version 17.0) with a significance level of 5%.

Results

Participants' characteristics

Fifty-one individuals, 33 men, mean age 58.8±13.5 years and a mean time since the onset of the stroke of 25.5 ± 13.9 months, participated. Their mean DASI and AAS scores were 29.8 ± 13.5 and 54.7 ± 16, respectively. Based upon their AAS scores, 18 participants were classified as impaired, 28 as moderately active, and five as active. Their characteristics are described in Table I

Table I - *Characteristics of the participants expressed in Mean ± SD and percentage (n=51).*

Characteristics	Impaired (n=18)			Moderately active (n=28)			Active (n=5)		
	Mean ± SD	Min-Max	p	Mean ± SD	Min-Max	p	Mean ± SD	Min-Max	p
Age (years)	59.8±10.5	44-84	0.53	62.3±11.9	38-83	0.58	41.2±15	30-61	0.04
Sex (men), n (%)	13(59.1%)	-	0.59	18(64.3%)	-	0.59	2(40%)	-	0.59
Body mass index (kg/m^2)	27.3±5.3	20-38	0.12	26.0±4.6	18-35	0.15	23.3±2.7	19-26	0.62
Paretic side (right), n (%)	14(63.6%)	-	0.60	16(57.1%)	-	0.60	4(80%)	-	0.60
Time since stroke (months)	21.5±10.6	12-56	0.00	27.2±15.3	12-60	0.00	32.8±15	12-51	0.97
Medication (number)	6.4±2.6	3-13	0.10	5.1±2.3	2-11	0.00	2.6±2.6	0-7	0.07
Walking speed (m/s)	0.93±0.3	0.17-1.60	0.81	1.3±0.4	0.46-2.30	0.72	1.5±0.3	1.23-2.00	0.83
AAS scores (0-94)	39.3±8.4	21-51	0.46	62.2±5.6	53-72	0.14	81.4±8.7	73-92	0.29

Shapiro-Wilk test was performed no evaluate normality; AAS = Adjusted activity scores of the Human activity profile.

Functional capacity according to the physical activity levels

Table II shows the comparisons between the impaired, moderately active, and active groups regarding their DASI scores. Between-groups differences were observed for the DASI

scores [F(2,48)=13.72; p<0.01], indicating that individuals with higher levels of physical activity demonstrated higher functional capacity.

Table II - *Mean (SD) DASI scores of the impaired, moderately active, and active groups, mean (SD) and mean (95% CI) of the differences between groups (n = 51).*

	Groups				Mean (95% CI) of the differences between the groups		
	Impaired (n=18)	Moderately active (n=28)	Active (n=5)	Between-group differences F (p) values	Impaired minus moderately active	Impaired minus active	Moderately active minus active
DASI scores	21.0 (11.3)	32.0 (11.5)	48.8 (2.6)	13.72 (<0.001)	-11 (-17.9 to -4.0)	-27.8 (-38.5 to -17.0)	-16.8 (-27.5 to -6.1)
p-value					0.003	0.001	0.002

Test used was Kruskal-Wallis and Mann-Whitney post-hoc test.

Discussion

This was the first study that used two simple questionnaires for the assessment of functional capacity and levels of physical activity after stroke. Both questionnaires are simple, accessible and easily applicable in clinical practice. The results of this study answered the main question, since it was found that the individuals with stroke with higher levels of physical activity demonstrated higher functional capacity, i.e., present higher METS energy cost (in METS). Recently, the study of Polese *et al.* [11] was the first to use the DASI for the assessment the functional capacity of a sample of 31 chronic stroke individuals, and found a mean DASI score of 27.3. This value was similar to that observed in the present study for the moderately active group, who showed a mean DASI score of 32.0 (SD 11.5).

In a previous study with 98 chronic stroke individuals, Polese *et al.* [21] reported that stroke individuals with higher levels of physical activity, as determined by the HAP scores, showed higher levels of functional capacity, as demonstrated by the distance covered during the 6-minute walking test (6MWT). They also found that individuals, who had lower strength deficits of the lower limb muscles, had higher physical activity levels. These findings corroborate those of the present study. However, in the present study, functional capacity was assessed with a simple and low-cost questionnaire, which does not depend on the environment context, like the 6MWT.

Previous studies have demonstrated that the encouragement of physical activity practice in stroke individuals resulted in beneficial effects on physiological, psychological, sensorimotor, strength, endurance, and functional measures [22-25]. Substantial health benefits are obtained from accumulating 150 minutes per week of moderate intensity or 75 minutes per week of vigorous-intensity aerobic activity, associated with strengthening exercises of moderate to high intensity performed ≥2 days per week [1,26]. Although it is well recognized the benefits of high levels of physical activity practice [1], little is known about the intensity of free-living physical activity in stroke individuals [27]. In this sense, only about 10% of the sample in the present study was considered active.

Chronic stroke individuals are able to perform about 50% of their peak oxygen consumption and their oxygen cost of walking is elevated, compared to that of able-bodied individuals of similar body weight [28]. They often show reduced fitness and are predisposed to sedentary lifestyles, which limit them to perform activities of daily living and contribute to increased risks for recurrent stroke and cardiovascular diseases [28]. Additionally, the sedentary behavior is an independent risk factor for cardiovascular diseases [27]. Thus, the results of the present study support the importance of assessing functional capacity, based upon the physical activity levels of these individuals, to better guide clinical practice.

Due to the nature of the study design, causal relationships between the studied variables cannot be determined. In addition, the data was not equally distributed between the groups regarding their physical activity levels, and this factor could influence the results. However, it is not common to find stroke individuals with high levels of physical activity in real life. It was observed a statistically significant difference in the baseline between the impaired, moderately active and active groups in the variables age, time since stroke and medication. These differences could be influenced by the different levels of physical activity of the

individuals. Finally, the findings of the present study could not be extrapolated to individuals with different characteristics from the studied sample.

Conclusion

In conclusion, physical activity levels of chronic stroke individuals influence their levels of functional capacity. Higher functional capacity was observed with increases in physical activity levels.

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